EXHIBIT G

TR 72585
Issue 1, April 1997

Bell Atlantic Technical Reference

Digital Unbundled Port Services Technical Specifications

Bell Atlantic Network Services, Inc.   TR 72585
Technical Reference   Issue 1, April 1997

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Digital Unbundled Port Services
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1.   General

1.01 This technical reference provides the technical specifications associated with the Digital Unbundled Port Services offered by Bell Atlantic (BA) in the co-carrier section of some local exchange tariffs or via contract.

1.02 Whenever this technical reference is reissued, the reason(s) for reissue will be provided in this paragraph.

1.03 Digital Unbundled Port Services (DUPS) enable Other Telephone Companies (OTC) that are collocated in a BA Central Office (CO) to connect to digital switch ports on BA local switching systems. The digital switch ports provide access to the functionality of the switch including supervisory signaling, digit reception and transmission, routing, rating, usage, as well as other line and trunk features.

1.04 The technical specifications in this document assume that the OTC is collocated in the same CO as the digital UPS. In the future, BA may offer transport services for DUPS. In that case, the technical specifications associated with the transport service will supersede those in this document where applicable.

2.   Service Description

A.   General

2.01 The service description, terms and conditions, prices, and Universal Service Order Codes (USOCs) for DUPS are contained in applicable tariffs or contracts.

2.02 DUPS are provided subject to availability on a first-come first-served basis. Special construction charges apply when appropriate facilities are not available.

2.03 DUPS vary according to the type of switch port (interface) and the services desired. This document contains the technical specifications associated with the digital switch ports. The services associated with the digital switch port are described in applicable tariffs and other technical references.

2.04 Digital ports provide a local switch interface that is suitable for the transmission of digital signals at the rates specified for each port.

2.05 The following DUPS are currently offered: Basic Rate ISDN (BRI), Centrex Basic Rate ISDN (CBRI), Primary Rate ISDN (PRI), DS1 message trunk interface (DS1MT), and DS1 Direct Inward Dialing (DS1DID). Other port types will be considered upon receipt of a bona-fide request.

2.06 DUPS ordinarily consists of the following elements:

(1) (a) For BRI and CBRI: Central Office Distributing Frame (CODF) wire and tie cable(s) between the CODF termination of the OTC transport equipment and the CODF termination of the BA switch port. (b) For PRI, DS1MT, and DS1DID: Digital Signal 1 Cross-Connect (DSX-1) wire and repeatered tie cable between the DSX-1 termination of the OTC transport equipment and the DSX-1 termination of the BA switch port. (In some cases, an electronic digital cross-connect (EDSX) system can be substituted for the DSX-1.)

(2) CO cabling between the CODF or DSX-1 and the BA Digital switch port; and,

(3) a digital switch port on a BA local switching system that is either;

    (a) a line-side Basic Rate ISDN or Centrex Basic Rate ISDN interface;
    (b) a line-side[1] DS1 interface for Primary Rate ISDN; or,
    (c) a trunk-side DS1 interface for Message Trunks, or Direct Inward Dialing trunks.

2.07 Each DUPS line-side port has the following basic characteristics and capabilities:

- an associated telephone number;
- access to local calling within the minimum BA-defined local calling area for each rate center;
- basic intercept;
- PIC1 and PIC2 (where deployed) access;
- access to 911;
- access to call routing, switch usage, and recording capability.

2.08 Each DS1DID trunk-side port has the following basic characteristics and capabilities:

- One-way call routing from the BA local switching system to the OTC for associated telephone numbers;
- wink-start address control signal;
- DP, DTMF, or MF address signaling;
- access to call routing and switch usage capabilities.

2.09 Each DS1MT trunk-side port has the following basic characteristics and capabilities:

- One-way call routing from the BA local switching system to the OTC for associated telephone numbers, or,
- One-way call routing from the OTC to the BA local switching system for associated telephone numbers:
- SS7 out-of-band signaling, or,

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[1] Primary Rate ISDN (PRI) services use a DS1 interface (port) on the local switching system. Depending upon the architecture of the local switching system, the port may be on the line-side or the trunk-side of the local switching system. Since the location of the port has no bearing on the functional characteristics of the port, for the purposes of this technical reference a line-side port is assumed.

- wink-start address control signal with MF address signaling; and ,
- access to call routing and switch usage capabilities.

2.10 The following list of supplementary features are some of the features that are available on line-side ports where technically feasible. Detailed feature lists by switch port type will be provided by the product manager.

- Additional listings
- Operator services
- Directory assistance
- Call Blocking (customer or OTC activated)
- Caller ID (calling number delivery)
- Speed calling
- 3-Way calling
- Call Forwarding (including Call Forwarding Busy and No Answer)
- Hunt group arrangements
- Visual message waiting indicator
- Usage recording and daily usage tapes indicating the to and from number and start and stop time by port

B.   Basic Rate ISDN (BRI)

2.11 BRI service consists of a 2-wire line-side port associated with a local switching system and a 2-wire CODF cross-connect between a 2-wire OTC CODF termination and the BRI CODF termination. At each 2-wire interface one conductor is called tip and the other conductor is called ring. A typical BRI port configuration is shown in Figure 2-1.

2.12 The BRI interface provides Line Termination (LT) functionality and utilizes the Two-Binary One-Quaternary (2B1Q) line code operating at 160 kbps that is described in Bellcore technical reference TR-NWT-000393 [1].

2.13 BRI is available in the 2B + D configuration which provides two B channels and one D channel (for signaling). BRI also supports a maintenance channel (M channel).
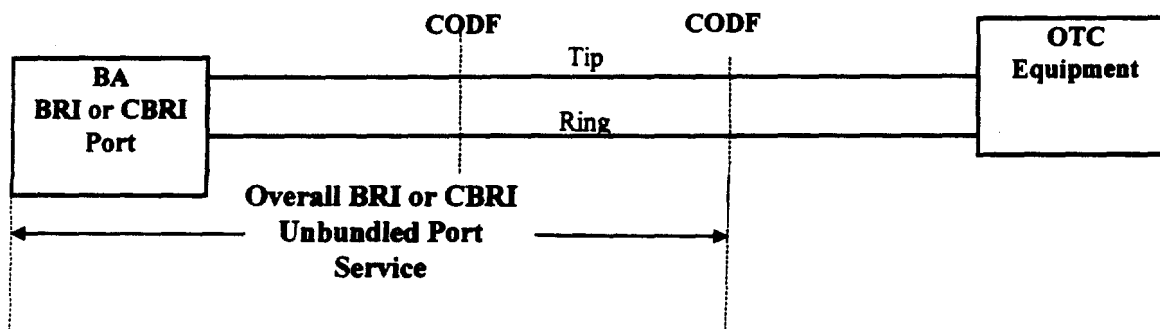
Figure 2-1. Typical BRI or CBRI Unbundled Port Configuration

C.   Centrex Basic Rate ISDN (CBRI)

2.14 CBRI service consists of a 2-wire line-side port associated with a local switching system and a 2-wire CODF cross-connect between a 2-wire OTC CODF termination and the CTX BRI CODF termination. At each 2-wire interface one conductor is called tip and the other conductor is called ring. A typical CBRI port configuration is shown in Figure 2-1.

2.15 The CBRI interface provides Line Termination (LT) functionality and utilizes the Two-Binary One-Quaternary (2B1Q) line code operating at 160 kbps that is described in Bellcore technical reference TR-NWT-000393 [1].

2.16 CBRI is available in the 2B + D configuration which provides two B channels and one D channel (for signaling). CBRI also supports a maintenance channel (M channel).

D.   Reserved for future use.

E.   Primary Rate ISDN (PRI)

2.17 PRI service consists of a 4-wire DSX-1 port associated with a local switching system and the 4-wire DSX-1 cross-connect between the OTC DSX-1 termination and the local switching system DSX-1 termination. A typical PRI port configuration is shown in Figure 2-2.

2.18 PRI ports are DSX-1 interfaces that meet the electrical specifications in ANSI T1.102 [3]. PRI service uses B8ZS line code and the Extended SuperFrame (ESF) Format described in ANSI T1.403 [5].

2.19 PRI is synchronized by the BA local switching system that uses timing that is traceable to a stratum one timing supply. The associated Building Integrated Timing Supply (BITS) meets the 3E specifications in ANSI T1.101 [6].

2.20 PRI is available in several configurations. The 23B + D configuration provides 23 B channels and one D channel (for signaling) that is always assigned to timeslot 24. The 24B configuration provides 24 B channels and signaling is carried over the D-channel of an associated PRI.
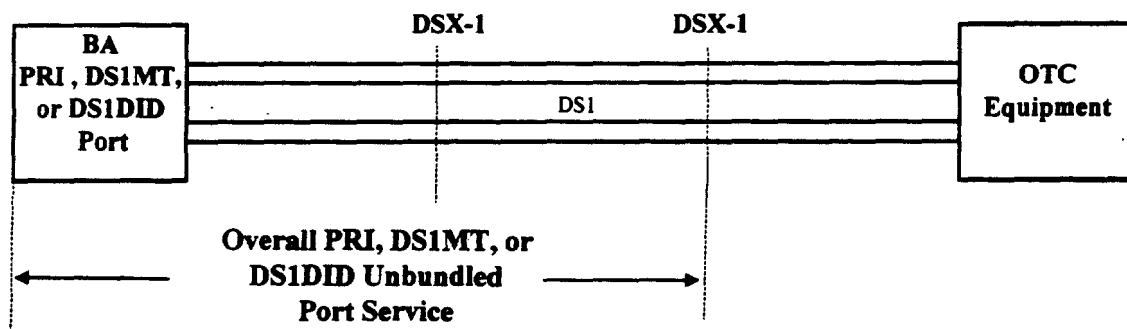

Figure 2-2. Typical PRI, DS1MT, or DS1DID Unbundled Port Configuration

2.21 Circuit Mode 3.1 kHz Audio is assumed for all calls originating from the Public Switched Telephone Network (PSTN). In addition, the analog voice grade signals on each DS0 for such calls are encoded and decoded using the μ255 coding scheme described in ITU-T Recommendation G.711 [4].

F.   DS1 Message Trunk (DS1MT)

2.22 DS1MT service consists of a 4-wire DSX-1 port associated with the trunk-side of a local switching system and the 4-wire DSX-1 cross-connect and repeatered tie cable between the OTC DSX-1 termination and the local switching system DSX termination. A typical DS1MT port configuration is illustrated in Figure 2-2.

2.23 DS1MT ports are DSX-1 interfaces that meet the electrical specifications in ANSI T1.102 [3]. DS1MT ports use the B8ZS line code and the ESF framing format described in ANSI T1.403 [5].

2.24 DS1MT ports are synchronized by the BA local switching system that uses a timing supply that is traceable to a stratum one clock as described in ANSI T1.101 [6]. The Building Integrated Timing Supply (BITS) meets the 3E clock specifications in ANSI T1.101 [6].

2.25 DS1MT ports are channelized into 24 DS0 channels.

2.26 For out-of-band common channel signaling (CCS) applications, each DS0 can carry a 56 kbps or 64 kbps information payload. Signaling System 7 (SS7) signaling conforming to Bellcore GR-905-CORE [7] will be used in such applications.

2.27 For non-CCS/SS7 applications, robbed bit supervisory signaling conforming to ANSI T1.403 [5], wink-start call control protocol, and MF signaling will be used. When robbed bit supervisory signaling is used, each DS0 is limited to a 56 kbps payload.

2.28 Analog voice grade signals on each DS0 are encoded and decoded using the μ255 coding scheme described in ITU-T Recommendation G.711 [4].

G.   DS1 Direct Inward Dialing (DS1DID)

2.29 DS1DID service consists of a 4-wire DSX-1 port associated with the trunk-side of a local switching system and the 4-wire DSX-1 cross-connect and repeatered tie cable between the OTC DSX-1 termination and the local switching system DSX termination. A typical DS1DID port configuration is illustrated in Figure 2-2.

2.30 DS1DID ports are DSX-1 interfaces that meet the electrical specifications in ANSI T1.102 [3]. DS1DID uses the AMI or B8ZS line code and the SF or ESF framing format described in ANSI T1.403 [5].

2.31 DS1DID ports are synchronized by the BA local switching system using a timing supply that is traceable to a stratum one clock as described in ANSI T1.101 [6]. The Building Integrated Timing Supply (BITS) meets the 3E clock specifications in ANSI T1.101 [6].

2.32 DS1DID ports are channelized into twenty-four 56 kbps DS0 channels. Each DS0 channel uses robbed bit supervisory signaling conforming to the loop reverse battery signaling (customer installation provided loop current feed) specifications in ANSI T1.403, Annex C [5].

2.33 Each DID DS0 channel uses the wink-start call control protocol and either dial pulse (DP), Dual Tone Multi-Frequency (DTMF), or Multi-Frequency (MF) address signaling. DP address signaling is transmitted using the robbed bit supervisory signaling. DTMF and MF address signaling is transmitted along with other voiceband frequencies in the DS0 payload after being encoded using the μ255 coding scheme described in ITU-T Recommendation G.711 [4].

2.34 Analog voice grade signals on each DS0 are encoded and decoded using the μ255 coding scheme described in ITU-T Recommendation G.711 [4].

H.   Network Channel and Network Channel Interface Codes

2.35 Network Channel (NC) and Network Channel Interface (NCI) codes are used for communicating channel and interface information. The NC/NCI code set facilitates the identification of network channel requirements and associated interface specifications for services described in tariffs.

2.36 For switched services, the NC code is an encoded representation of the channel that is provided from the OTC Point Of Termination (POT) to the BA CO. By varying the NC code, the customer is allowed to further specify the type of service.

2.37 The most common DUPS NC codes are shown in figure 2-3. The complete set of NC codes for DUPS and other services may be found in SR-STS-000307 [9].

2.38 The NCI code is an encoded representation used to identify five interface elements located at a POT. The five elements reflect the following physical and electrical characteristics: number of physical conductors, protocol, impedance, protocol options, and transmission levels points (if applicable).

2.39 Valid DUPS NCI codes are shown in Figure 2-4.

2.40 Valid Digital NC/NCI code combinations are shown in Figure 2-5. Complete NC/NCI compatibility for DUPS and other services may be found in SR-STS-000323 [10].

Figure 2-3: DUPS NC Codes

Service	NC Code	Character 3		Character 4	
BRI & CBRI	SN	A	(2-Wire)	L	(line side)
Primary Rate ISDN	HC	E	(ANSI ESF & B8ZS)	E	(PRI 24B)
				I	(PRI 23B + D)
DS1 Message Trunk	SD	U		K	(EO to EO SS7)
				L	(EO to LT SS7)
DS1 DID	SD	-		Y	(DID - DTMF)

Figure 2-4: DUPS NCI Codes

NCI Code	Description
02QC5.OOS	Basic Rate ISDN
02QC5.OOS	Centrex Basic Rate ISDN
04QB9.11	Primary Rate ISDN
04QB9.11	DS1 Message Trunk
04QB9.11	DS1 Direct Inward Dialing

Figure 2-5: Valid NC/NCI Code Combinations

Service	NC Code	NCI Code
Basic Rate ISDN	SNAL	02QC5.OOS
Centrex Basic Rate ISDN	SNAL	02QC5.OOS
Primary Rate ISDN (24B)	HCEE	04QB9.11
Primary Rate ISDN (23B+D)	HCEI	04QB9.11
DS1 Message Trunk (EO to EO SS7)	SDUK	04QB9.11
DS1 Message Trunk (EO to Tandem SS7)	SDUL	04QB9.11
DS1 Direct Inward Dialing	SD-Y	04QB9.11

3. Service Elements

A. General

3.01 Three elements are always used with BRI and CBRI Unbundled Port Services. They are: CODF cross-connect wiring and tie cable(s), BA local switching system CO voice frequency (VF) cabling, and a BA local switching system port. Figure 3-1 illustrates the BRI and CBRI Unbundled Port Service elements and identifies the sections of this document that contain the requirements for each of the elements.
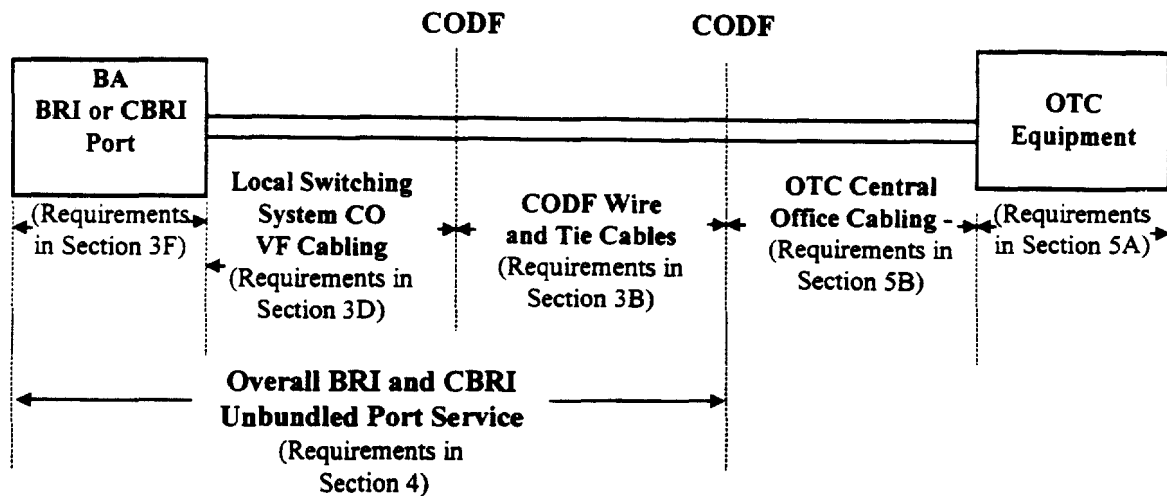
Figure 3-1. BRI and CBRI Unbundled Port Service Elements

3.02 Three elements are always used with the DS1s associated with the PRI, DS1MT, and DS1DID Unbundled Port Services. They are: DSX-1 cross-connect wiring and tie cable(s), BA local switching system CO DSX-1 cabling, and a BA local switching system DS1 port. Figure 3-2 illustrates the PRI, DS1MT, and DS1DID Unbundled Port Service elements and identifies the sections of this document that contain the specifications for each of the elements.

B.   CODF Wiring and Tie Cable(s)

3.03 CODF cross-connect wiring and tie cable(s) are used to link the CODF termination of OTC transport equipment to the CODF termination of the BA BRI or CBRI port.

3.04 The total combined length of all CODF cross-connect wiring and all CODF-to-CODF tie cables used for DUPS should be less than 1500 feet.

3.05 The direct-current resistance of the CODF wiring and tie cable used for DUPS should be less than 80 ohms. This is equal to 1500 or less feet of 24 gauge cable.
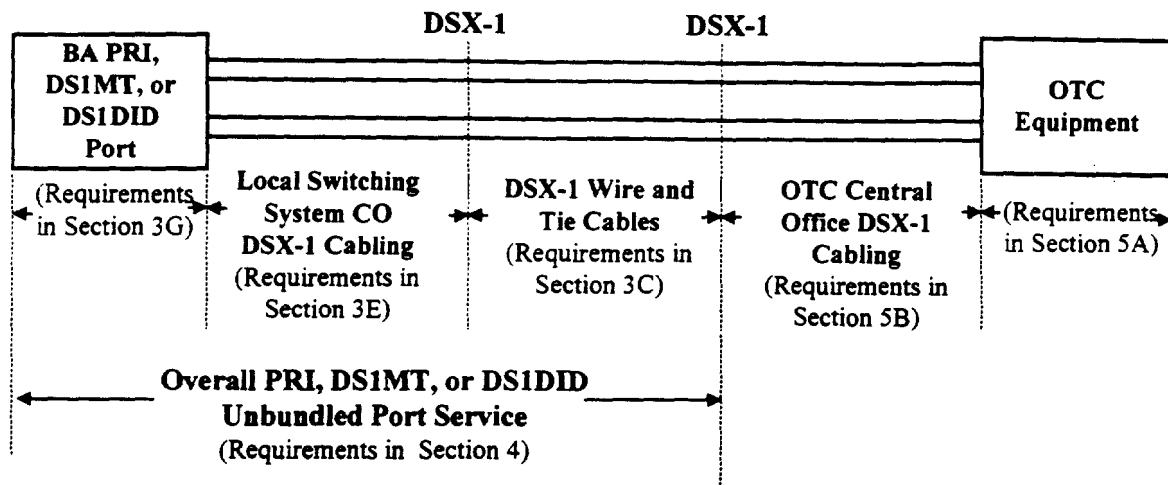
Figure 3-2. PRI, DS1MT, and DS1DID Unbundled Port Service Elements

C.   DSX-1 Wiring and Repeatered Tie Cable(s)

3.06 DSX-1 cross-connect wiring and tie cable(s) are used to link the DSX-1 termination of OTC equipment to the DSX-1 termination of the BA PRI, DS1MT, or DS1DID port. In some cases, an electronic digital cross-connect (EDSX) system may be substituted for the DSX-1.

3.07 The total length of all DSX-1 cross-connect wiring should be less than 185 feet.

3.08 When repeatered tie cables are used to link OTC DSX-1 terminations to BA DSX-1 terminations, the cabling between the repeaters and the DSX-1 panels shall be built-out in each direction of transmission such that the overall cabling and build-out is the equivalent of 655 feet of 22 gauge ABAM cable.

D.   Bell Atlantic Local Switching System CO Voice Grade Cabling

3.09 The voice-grade CO cabling used to terminate BRI or CBRI local switching system ports on the CODF shall use twisted-pair conductors.

3.10 The type, gauge, and length of the BA CODF cabling shall be specified based on this specification and BA equipment vendor requirements. If the specifications in this document differ from the equipment manufacturers specifications, then the more stringent of the two shall be used.

3.11 The direct-current resistance of the CO cabling between the BA local switching system port and the CODF shall meet the CO cabling requirements in the Bellcore FR-TSY-000064 [11] (i.e., 23 ohms or less). This is equivalent to 275 feet or less of 26 gauge cable, 440 feet or less of 24 gauge cable, and 700 feet or less of 22 gauge cable.

E. Bell Atlantic Local Switching System CO DSX-1 Cabling Requirements

3.12 BA cabling between the Local Switching System and the DSX-1 panels shall be built-out in each direction of transmission such that the overall cabling and build-out is the equivalent of 655 feet of 22 gauge ABAM cable.

F. BRI and CBRI Local Switching System Ports

3.13 The BRI and CBRI line-side ports shall conform to the LT specifications in TR-NWT-000393 [1] and the network specifications in ANSI T1.601-1993 [12].

G. PRI, DS1MT, and DS1DID Local Switching System Ports

3.14 The PRI port shall conform to the DSX-1 specifications in ANSI T1.102 [3], the B8ZS and ESF requirements in ANSI T1.403 [5], the network requirements in ANSI T1.408 [13], the timing requirements in ANSI T1.101 [6], and (for PSTN calls) the $\mu255$ coding scheme in ITU-T Recommendation G.711 [4].

3.15 The DS1MT port shall conform to the DSX-1 specifications in ANSI T1.102 [3], the B8ZS and ESF requirements in ANSI T1.403 [5] and the $\mu255$ coding scheme in ITU-T Recommendation G.711 [4]. In SS7 applications, the DS1MT shall conform to the specifications in GR-905-CORE. In MF applications, the DS1MT shall conform to the robbed-bit signaling specifications in ANSI T1.403 Annex C [5] and the MF signaling requirements in FR-NWT-000064 [11].

3.16 The DS1DID port shall conform to the DSX-1 specifications in ANSI T1.102 [3], the AMI or B8ZS and SF or ESF requirements in ANSI T1.403 [5], the robbed-bit signaling specifications in ANSI T1.403 Annex C [5], the $\mu255$ coding scheme in ITU-T Recommendation G.711 [4], and the DP, DTMF, or MF signaling requirements in FR-NWT-000064 [11].

4. Service Specifications

A. General

4.01 The overall end-to-end DUPS service is from the CODF or DSX-1 termination of the OTC equipment to the BA local switching system port.

4.02 DUPS should meet the limits of this section when measured at the BA local switching system port. Parameters are usually tested in response to trouble reports or when additional testing is purchased.

B.   BRI and CBRI

4.03 The overall end-to-end BRI or CBRI service is from the CODF termination of the OTC equipment to the local switching system port (see figure 2-1).

4.04 BRI and CBRI Acceptance Limits (AL) and Immediate Action Limits (IAL) are shown in Table 4-1.

4.05 BRI and CBRI services shall meet the LT specifications in TR-NWT-000393 [1] and the network specifications in ANSI T1.601-1993 [12].

Table 4-1: BRI and CBRI
Acceptance Limits (AL) and Immediate Action Limits (IAL)

Parameter	AL	IAL
40 kHz loss	< 6.0 dB	> 6.0 dB
Resistance	< 130 ohms	> 130 ohms
Leakage	> 5 Megaohms	< 5 Megaohms

C.   PRI, DS1MT, and DS1DID

4.06 The overall end-to-end PRI, DS1MT, and DS1DID service is from the DSX-1 termination of the OTC equipment to the digital port on the local switching system.

4.07 PRI service shall meet the B8ZS and ESF specifications in ANSI T1.403 [5], the network specifications in ANSI T1.408 [13], and the 3E timing requirements in ANSI T1.101 [6].

4.08 DS1MT service shall meet the B8ZS   and ESF specifications in ANSI T1.403 [5]. If SS7 signaling is used, it shall conform to the specifications in GR-905-CORE [7] and BA 905 [8]. If MF signaling is used, it shall conform to the MF requirements in FR-NWT-000064 [11] and the robbed-bit signaling specifications in ANSI T1.403 Annex C [5].

4.09 DS1DID service shall meet the AMI or B8ZS and SF or ESF specifications in ANSI T1.403 [5]. The robbed-bit signaling specifications in ANSI T1.403 Annex C [5], and the DP, DTMF, or MF signaling requirements in FR-NWT-000064 [11].

4.10 The PRI, DS1MT, and DS1DID services consist of one DS1. The electrical signals of each DS1 at the OTC POT shall meet the DSX-1 specifications in ANSI T1.102 [3].

4.11 Accuracy and availability performance objectives for each PRI, DS1MT, and DS1DID are shown in Figure 4-2. DS1 performance test limits are shown in Figure 4-3.

4.12 Availability is a measure of the relative amount of time that a service is "usable" by the customer. Unavailability begins when the Bit Error Ratio (BER) in each second is worse than 1×10^{-3} for a period of 10 consecutive seconds. The DS1 objective is 99.925 percent availability in any twelve consecutive months. Availability equals the total time minus the outage time divided by the total time.

4.13 Accuracy denotes the error performance and is usually specified in terms of errored seconds (ES), or conversely, error-free seconds (EFS). EFS are the primary measure of error performance for DS1s. An EFS is any second that an error does not occur.

4.14 A Severely Errored Second (SES) is any one second interval that has a BER of less than (worse than) 1×10^{-3}.

4.15 Acceptance and maintenance tests for DS1s should be performed with a Quasi-Random Signal Source (QRSS), on an OTC-POT to local switching system basis, using the Errored Second and Severely Errored Second performance parameters in Figure 4-3.

4.16 Other tests may be performed in response to trouble reports or when additional testing is purchased. The All Ones, 3/24, and 1/8 patterns are acceptable diagnostic stress tests. The pattern sensitivity test criteria associated with these patterns is provided in Figure 4-4.

4.17 If errors are detected using the QRSS or 1/8 patterns, it is recommended that the DS1 line code options (AMI/B8ZS) be verified using the procedures outlined in the Bell Atlantic Network Services Reference Manual Series 72710 & NS6050 and the test criteria in Figure 4-4. These tests make use of the Framed 3/24 and Framed All Zeros patterns.

Figure 4-2: DS1 Performance Objectives

Parameter	Objective
Accuracy	0.25 % errored seconds long-term (30 days or more)
Availability	99.925 % per year

Figure 4-3: DS1 Acceptance and Maintenance Test Limits[2]

Test Duration	Errored Seconds	Severely Errored Seconds
15 min	0	0
30 min	3	0
45 min	5	2
24 hours	150	7

Figure 4-4: Pattern sensitivity test criteria (see notes 1 and 2)

TEST PATTERN (see note 3)	TEST DURATION	ACCEPTANCE LIMIT
All Ones	5 minutes	0
3/24 (AMI only)	5 minutes	0
1/8	5 minutes	0
Framed All Zeros (4) (B8ZS only)	30 seconds	(see note 5)

Notes:

(1) Test patterns should be framed.

(2) One retest is allowed if the initial test fails.

(3) If compatible test equipment is not available to perform these tests, loopback testing should be utilized.

(4) WARNING: If used with the DS1 SF framing format, zeros will occur in time slot 2 of every octet (channel). Terminal equipment will display a false Remote Alarm Indication (a.k.a., yellow alarm). In addition, the use of the framed all-zeros pattern through some types of DS3 equipment may cause DS1 failure if the equipment is not properly optioned for B8ZS.

(5) As an equipment option check, failure will typically be seen as large error counts. Very low counts (e.g., 1 or 2 errors) are not indicative of an optioning problem.

5.   OTC Equipment and CO Cabling Requirements

A.   OTC Equipment Requirements

5.01 Collocated OTC equipment shall meet all of the applicable generic equipment requirements in Bellcore GR-63-CORE [14] and GR-1089-CORE [15].

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[2] While some of the entries in this table are "0", it should be noted that an isolated error event is not necessarily indicative of a service affecting problem.

5.02 Collocated OTC equipment shall be manufactured in accordance with FCC, NEC, UL, and USDL requirements and orders applicable to Federal, State, and local requirements including, but not limited to, statutes, rules, regulations, orders, or ordinances, or otherwise imposed by law. Where requirements are not specified in this document, contractual technical requirements, or other applicable documents, the manufacturer's requirements consistent with industry standards shall be met.

5.03 The open circuit tip-to-ring dc voltage that collocated OTC equipment applies to BA VF cabling shall be less than 80 Vdc.

5.04 Collocated OTC equipment shall not deliver more than 2.5 watts of power to any load via BA VF cable.

5.05 Collocated OTC equipment shall not deliver more than 100 mA of loop current to any load via BA VF cable.

5.06 OTC equipment connecting to BRI and CBRI ports shall conform to the NT specifications in TR-NWT-000393 [1] and the customer installation specifications in ANSI T1.601-1993 [12].

5.07 OTC equipment connecting to PRI ports shall conform to the DSX-1 specifications in ANSI T1.102 [3], the B8ZS and ESF specifications in ANSI T1.403 [5], the customer installation requirements in ANSI T1.408 [13], the timing requirements in ANSI T1.101 [6], and the μ255 coding scheme in ITU-T Recommendation G.711 [4].

5.08 OTC equipment connecting to DS1MT ports shall conform to the DSX-1 specifications in ANSI T1.102 [3], the B8ZS and ESF specifications in ANSI T1.403 [5], and the μ255 coding scheme in ITU-T Recommendation G.711 [4]. For SS7 applications, OTC equipment shall also conform to the specifications in GR-905-CORE [7] and BA 905 [8]. For MF applications, OTC equipment shall also conform to the robbed-bit signaling specifications in ANSI T1.403 Annex C [5] and the MF signaling requirements in FR-NWT-000064 [11].

5.09 OTC equipment connecting to the DS1DID port shall conform to the DSX-1 specifications in ANSI T1.102 [3], the AMI or B8ZS and SF or ESF specifications in ANSI T1.403 [5], the robbed-bit signaling specifications in ANSI T1.403, Annex C [5], and the μ255 coding scheme in ITU-T Recommendation G.711 [4], and the DP, DTMF, or MF signaling requirements in FR-NWT-000064 [11].

B.   OTC CO VF Cabling Requirements

5.10 The voice-grade CO cabling used to terminate OTC equipment on the CODF for interconnection with BRI or CBRI port services shall use twisted-pair conductors.

5.11 The type, gauge, and length of the OTC CODF cabling shall be specified based on this specification and OTC equipment requirements. If the specifications in this document differ from the OTC equipment manufacturers specifications, then the more stringent of the two shall be used.

5.12 The direct-current resistance of the CO cabling between the OTC equipment and the CODF shall meet the CO cabling requirements in the Bellcore FR-TSY-000064 [11] (i.e., 23 ohms or less). This is equivalent to 275 feet or less of 26 gauge cable, 440 feet or less of 24 gauge cable, and 700 feet or less of 22 gauge cable.

C. OTC DSX-1 Cabling Requirements

5.13 OTC DSX-1 cabling and build-out in each direction of transmission shall be the equivalent of 655 feet of 22 gauge ABAM cable.

6. References

A. Definitions

Acceptance Limit (AL)
The maximum margin, value, or deviation that is allowed at service turnup or customer acceptance.

Alternate Mark Inversion (AMI)
A DS1 line code that does not perform zero code suppression and is therefore transparent to an all zeros byte.

Basic Rate ISDN (BRI)
Basic Rate ISDN is a 2-wire line-side local switching system port that uses the two-bit one-quaternary line code at a 160 kilobit per second rate to transport overhead and up to two B channels and one D channel.

B Channel
The B channel, or bearer channel, is a 64 kbps channel used for information transfer between users.

Bipolar Eight Zero Substitution (B8ZS)
A DS1 line code that performs zero code suppression by replacing an all zeros byte with a special pattern of ones and zeros that contains two consecutive bipolar violations.

Bit Seven (BIT7)
A TR08 DS1 line code that performs zero code suppression by placing a one in bit 7 of an all zeros byte.

Central Office (CO)
A telephone company building which houses equipment and facilities used to provide switched access services.

Central Office Distributing Frame (CODF)
Framework located in a CO that holds wire cross-connects which are used to interconnect cable terminations for end-user customer loops, switching system ports, and inter-office facilities.

Channel
An electrical, or photonic communications path between two or more points of transmission.

D Channel
The D channel is a packet-switched channel that carries signaling and control for B channels. In BRI applications, it can also support customer packet data traffic at speeds up to 9.6 kilobits per second.

DS1 Message Trunk (DS1MT)
A digital trunk-side port of a local switching system that operates at 1.544 Mbps and is channelized to provide twenty-four 64 kbps or 56 kbps trunks for the message telecommunications network..

Digital Unbundled Port Services (DUPS)
A service, not bundled with a loop or transport facility, that provides digital access to the functionality of a local switching system.

Extended SuperFrame (ESF)
A type of DS1 framing format that utilizes the framing bit of twenty-four consecutive frames to provide a 2 kbps framing pattern sequence, a 4 kbps data link, and a 2 kbps cyclic redundancy check channel.

Immediate Action Limit (IAL)
The bound of acceptable performance and the threshold beyond which BA will accept a customer's trouble report and take immediate corrective action.

Integrated Services Digital Network (ISDN)
ISDN describes the end-to-end digital telecommunications network architecture which provides for the simultaneous access, transmission , and switching of voice, data, and image services. These functions are provided via channelized transport facilities over a limited number of standard user-network interfaces.

Line Termination (LT)
Equipment that terminates a BRI or Centrex BRI digital subscriber line on the network side of the network to customer (or OTC) interface.

Maintenance Limit
The maximum margin, value, or deviation associated with normal in-service performance.

Network Termination (NT)
Equipment that terminates a BRI or CTX BRI digital subscriber line on the customer (or OTC) side of the network to customer (or OTC) interface.

Other Telephone Company (OTC)

The term "Other Telephone Company" (OTC) denotes any individual, partnership, association, joint-stock company, trust, governmental entity, or corporation engaged for hire in intrastate exchange communication by wire, fiber, or radio.

Point Of Termination (POT)

The point of demarcation at which the BA's responsibility for the provision of services ends.

Protocol Code

A component of an interface code that is readily associated with the basic electrical function of the interface.

Primary Rate ISDN (PRI)

PRI is a 4-wire 1.544 Mbps (DS1) local switching system port that uses the B8ZS line code and the ESF framing format. PRI is available in a twenty-three B channel plus one D channel (23B + D) configuration or a twenty-four B channel (24B) configuration.

SuperFrame (SF)

A type of DS1 framing format that utilizes the framing bit of twelve consecutive frames to provide terminal framing and signaling framing.

Two Binary, One Quaternary (2B1Q)

A line code used for BRI and Centrex BRI where each two bits of the binary data stream are combined into a single four-level pulse amplitude modulation signal.

Unbundled Port

An interface (port) on a local switching system, that is not bundled with a loop or transport facility, that provides access to and from the public switched telephone network and the functionality of the local switching system.

Voice-Grade (VG)

A term used to describe a channel, circuit, facility, or service that is suitable for the transmission of speech, digital or Digital data, or facsimile, generally with a frequency range of about 300 to 3000 Hz.

B.   Acronyms

ABAM	Cable Type
AL	Acceptance Limit
ANSI	American National Standards Institute
BA	Bell Atlantic
BRI	Basic Rate ISDN
B8ZS	Bipolar Eight Zero Substitution
OTC	Other Telephone Company
CO	Central Office

CODF	Central Office Distributing Frame
DID	Direct Inward Dialing
DSX-1	Digital Signal Cross-Connect One
DS1	Digital Signal One (1.544 Mbps)
DS1DID	DS1 Direct Inward Dialing
DS1MT	DS1 Message Trunk
DUPS	Digital Unbundled Port Services
ESF	Extended Superframe Format
FCC	Federal Communications Commission
IAL	Immediate Action Limit
IDLC	Integrated Digital Loop Carrier
IEEE	International Electrical and Electronic Engineers
LT	Line Termination
NC	Network Channel
NCI	Network Channel Interface
NEC	National Electric Code
POT	Point Of Termination
POTS	Plain Ordinary (analog) Telephone Service
RBS	Robbed-Bit Signaling
SF	Superframe Format
TR08	Technical Reference TR-NWT-000008
UL	Underwriter's Laboratory
USDL	United States Department of Labor
USOC	Universal Service Order Code
VF	Voice Frequency
VG	Voice Grade
2B1Q	Two-Bit One-Quaternary

7.   Bibliography

1- Technical Reference TR-NWT-000393, Generic Requirements for ISDN Basic Access Digital Subscriber Lines, Issue 2, (Bellcore, April 1991).

2- Technical Reference TR-TSY-000008, Digital interface Between the SLC®96 Digital Loop Carrier System And A Local Digital Switch, Issue 2, (Bellcore, August 1987).

3- American National Standard for Telecommunications - Digital Hierarchy - Electrical Interfaces, ANSI T1.102-1993.

4- ITU-T Recommendation G.711, Pulse Code Modulation (PCM) of Voice Frequencies, Blue Book Fasc. III.4, (ITU-TSS, 1988).

5- American National Standard for Telecommunications - Network-to-Customer Installation - DS1 Metallic Interface, ANSI T1.403-1995.

6- American National Standard for Telecommunications - Synchronization Interface Standards for Digital Networks, ANSI T1.101-1994.

7- Generic Requirements GR-905-CORE, Common Channel Signaling Network Interface Specification (CCSNIS) Supporting Network Interconnection, Message Transfer Part (MTP), and Integrated Services Digital Network User Part (ISDNUP), Issue 2, (Bellcore, December 1996).

8- BA905, Bell Atlantic Supplement Common Channel Signaling Network Interface Specification.

9- Special Report SR-STS-000307, Issue 3, *Industry Support Interface (ISI): NC/NCI Code Dictionary*, Bellcore, April 1992.

10- Special Report SR-STS-000323, *NC/NCI Compatibility Guide*, Issue 4, (Bellcore, May 1994).

11- Technical Reference FR-NWT-000064, LATA Switching Systems Generic Requirements (LSSGR), (Bellcore, 1994).

12- American National Standard for Telecommunications - ISDN Basic Access Interface for use on Metallic Loops for Application at the Network Side of NT, Layer 1 Specification, ANSI T1.601-1992.

13- American National Standard for Telecommunications - ISDN Primary Rate - Customer Installation Metallic Interfaces - Layer 1 Specification, ANSI T1.408 -1990.

14- Generic Requirements GR-63-CORE, Network Equipment-Building System (NEBS) Requirements: Physical Protection, Issue 2, (Bellcore, October 1995).

15- Generic Requirements GR-1089-CORE, Electromagnetic Compatibility and Electrical Safety - Generic Criteria for Network Telecommunications Equipment, Issue 1, Rev 1, (Bellcore, November 1996).

NOTE: These documents are subject to change. References reflect the most current information available at the time of printing. Readers are advised to check the status and availability of all documents.